WHAT IS CLAIMED IS:

1. A polynucleotide which is (a) a polynucleotide having a nucleotide sequence of SEQ ID NO:1; (b) a polynucleotide having a nucleotide sequence of SEQ ID NO: 4; or (c) a polynucleotide fragment of (a) or (b) encoding a functional domain of a cellulose synthase.

2. The polynucleotide of claim 1 wherein the polynucleotide is operably linked to a polynucleotide of SEQ ID NO: 3, or a functional fragment thereof.

3. A vector comprising a polynucleotide of claim 1.

4. A transgenic plant comprising a polynucleotide of claim 1.

5. A cellulose synthase promoter, or a functional fragment thereof which binds a transcription factor in a plant cell.

6. A vector comprising a promoter or a fragment of claim 5.

7. A transgenic plant comprising a promoter or a fragment of claim 5.

8. A polypeptide having an amino acid sequence of SEQ ID NO: 2, an amino acid sequence of SEQ ID NO: 5 or an amino acid sequence sequence which a functional domain of cellulose synthase.

9. A method of altering the growth of a plant, comprising expressing in cells of the plant an exogenous polynucleotide encoding a cellulose synthase wherein the polynucleotide is expressed in an amount effective to alter the growth of the plant.

10. A method according to claim 9, wherein the polynucleotide comprises a homologous polynucleotide.

11. A method according to claim 9, wherein the polynucleotide comprises a heterologous polynucleotide.

12. A method according to claim 9, wherein the polynucleotide is in a sense orientation.

13. A method according to claim 9, wherein the polynucleotide is in an antisense orientation.

14. A method according to claim 9, wherein a plant promoter, or a transcription factor binding domain thereof, is operatively linked to the polynucleotide.

15. A method according to claim 14, wherein the promoter is selected from constitutive promoters, tissue-specific promoters and developmental-specific plant promoters.

16. A method according to claim 15, wherein the promoter is Cauliflower Mosaic Virus 35S, 4CL, cellulose synthase promoter, *PtCelAP* or terminal flower promoter.

17. A polynucleotide encoding a UDP-glucose binding domain of a cellulose synthase.

18. A polypeptide comprising a UDP-glucose catalytic subunit of cellulose synthase wherein the UDP-glucose catalytic subunit catalyzes the biosynthesis of cellulose.

19. A method of altering the growth of a plant, comprising incorporating into a plant genome a polynucleotide encoding a UDP-glucose catalytic subunit wherein expression of the polynucleotide alters the growth of the plant.

20. A method according to claim 19, wherein the polynucleotide comprises a homologous polynucleotide.

21. A method according to claim 19, wherein the polynucleotide comprises a heterologous polynucleotide.

22. A method according to claim 19, wherein the polynucleotide is in a sense orientation.

23. A method according to claim 19, wherein the polynucleotide is in a antisense orientation.

24. A method of altering the cellulose content in a plant comprising expressing an exogenous polynucleotide encoding a UDP-glucose binding domain in a plant genome to alter the cellulose content of the plant.

25. A transgenic plant having an increased ratio of cellulose to lignin in cells of the plant comprising an exogenous polynucleotide encoding a cellulose synthase operably linked to a promoter so that the polynucleotide is expressed in an amount effective to increase the cellulose content of the plant.

26. A transgenic plant having a decreased ratio of lignin to cellulose, the plant comprising an exogenous polynucleotide encoding a cellulose synthase.

27. A method of altering expression of a cellulose synthase in a plant cell comprising delivering into the cell a vector comprising a polynucleotide encoding a cellulose synthase.

28. The method according to claim 27, wherein the polynucleotide comprises a homologous polynucleotide.

29. The method according to claim 27, wherein the polynucleotide comprises a heterologous polynucleotide.

30. The method according to claim 27, wherein the polynucleotide is in a sense orientation.

31. The method according to claim 27, wherein the polynucleotide is in a antisense orientation.

32. A method of causing stress-induced gene expression in a plant cell comprising delivering into the cell a vector comprising a cellulose synthase promoter operatively linked to a gene, wherein the gene is expressed upon a mechanical stress to the plant.

33. A method of determining a positive mechanical stress responsive element (MSRE) in a cellulose synthase promoter comprising:

(i) introducing into a plant a cellulose synthase promoter that has a portion deleted, the cellulose synthase promoter operatively linked to a polynucleotide encoding a reporter, and

(ii) detecting a decrease in the amount of reporter in the plant after inducing a stress to the plant.

34. A method of determining a negative MSRE in a cellulose synthase promoter comprising:

(i) introducing into a plant a cellulose synthase promoter that has a portion deleted, the cellulose synthase promoter operatively linked to a reporter gene, and

(ii) detecting an increase in the amount of reporter in the plant after inducing a stress to the plant.

35. A method of expressing cellulose synthase in a plant in a tissue-specific manner comprising transforming the plant with a tissue-specific promoter operatively linked to a polynucleotide encoding a cellulose synthase.

36. A method of increasing expression of a cellulose synthase in a plant comprising delivering into the plant a cDNA encoding a protein that binds to a positive MSRE of a cellulose synthase promoter wherein the binding to the positive MSRE results in expression of a cellulose synthase, resulting in increased expression of cellulose in the plant.

37. A method of reducing expression of a cellulose synthase in a plant comprising delivering into the plant a cDNA in an antisense orientation, the cDNA in a sense orientation encoding protein that binds to a positive MSRE and results in expression of a cellulose synthase.

38. A method of increasing cellulose biosynthesis in a plant comprising delivering into the plant a cDNA encoding a protein that binds to a positive MSRE of a cellulose synthase promoter, wherein binding of the protein to the positive MSRE results in expression of a cellulose synthase.

39. A method of reducing cellulose biosynthesis in a plant comprising delivering into the plant a cDNA in an antisense orientation, the cDNA in a sense orientation encoding protein that binds to a positive MSRE of a cellulose synthase promoter.

40. A transgenic plant containing a polynucleotide comprising a promoter and encoding a cellulose synthase, the polynucleotide expressed such that the growth of the plant is altered relative to a similar control plant that does not contain the polynucleotide.

41. A vector comprising a promoter functional in a plant cell, and a coding sequence for cellulose synthase, the coding sequence operably linked to the promoter, the promoter having a nucleotide sequence encoding a positive MSRE of cellulose synthase.

42. A method of altering a characteristic of a plant comprising genetically upregulating cellulose synthase in the plant, wherein the characteristic is accelerated growth, increased cellulose content or decreased lignin content.

43. The method of claim 42 wherein the plant is genetically upregulated through incorporation into the genome of the plant a cDNA having a nucleotide sequence encoding a cellulose synthase.

44. A method of regulating cellulose synthase expression in a plant comprising delivery in a plant (a) a cDNA encoding a polypeptide which is a positive MSRE of a cellulose synthase promoter; or (b) a cDNA in an anti sense orientation of the cDNA of (a), in amount and under conditions effective to allow at least a portion of the plant's cells to take up the cDNA.

45. A method of altering cellulose content in a plant comprising:

(a) delivery into cells of the plant an expression cassette comprising a cDNA encoding a cellulose synthase operably linked to a promoter functional in a plan cell; and

(b) expressing the cDNA in the cells of the plant in an amount effective to alter the cellulose content in the cells of the plant.

46. A DNA encoding a protein having cellulose synthase activity and comprising the amino acid sequence in SEQ ID NO:2, SEQ ID NO:5 or an amino acid sequence which is a functional domain of cellulose synthase.